

Towards a climatology of stratospheric bromine monoxide from SCIAMACHY limb measurements

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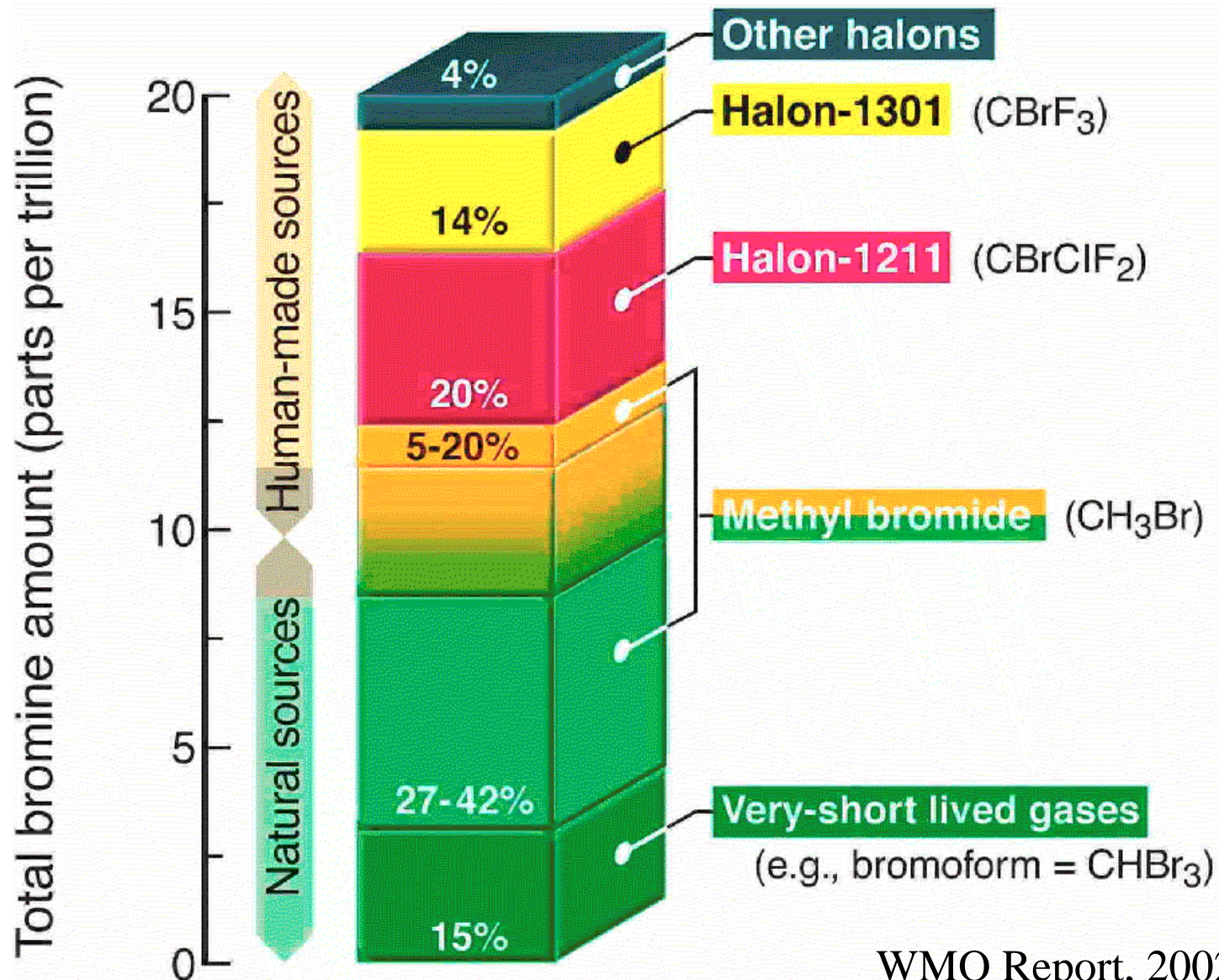


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- Halogens compounds play an important role in ozone depletion.
- Bromine compounds are more active in destroying ozone at per molecule level than chlorine compounds.

Sources of Bromine



WMO Report, 2002

- $\text{Br}_y = \text{Br}, \text{BrO}, \text{BrONO}_2, \text{HBr}, \text{HOBr}, \text{BrCl}.$
- Despite their important role in ozone depletion there are very few measurements of bromine compounds.

- **SCIAMACHY provides first global profiles of BrO.**

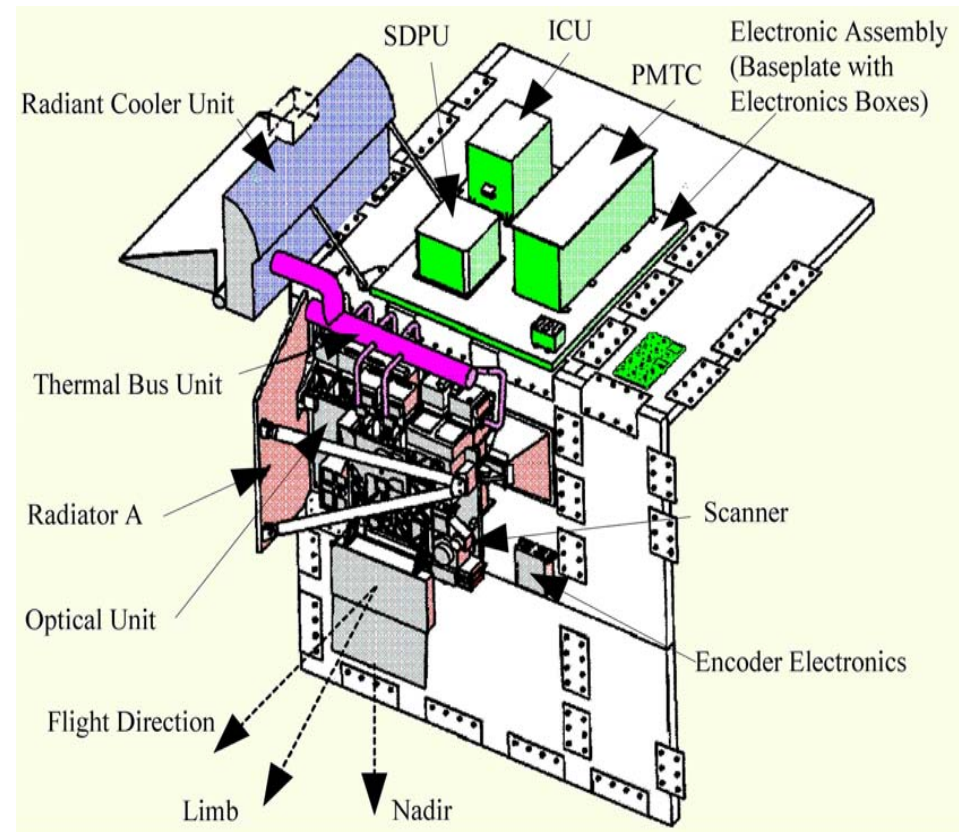
- Features:

- UV/Vis/NIR grating spectrometers:
- 220 - 2380 nm
- Moderate spectral resolution:

- 0.2 – 1.5 nm

- Measurements:

- Atmospheric radiance: scattered, reflected and transmitted sunlight
- Extraterrestrial solar irradiance
- Lunar radiance



Retrieval procedure

- Forward problem

Calculate the outgoing radiances given temperature and trace-gas profiles.

For BrO :The outgoing radiances and weighting functions are computed in the spectral window 335 to 360 nm at TH between 12 and 38 km.

- Inverse problem / Retrieval problem

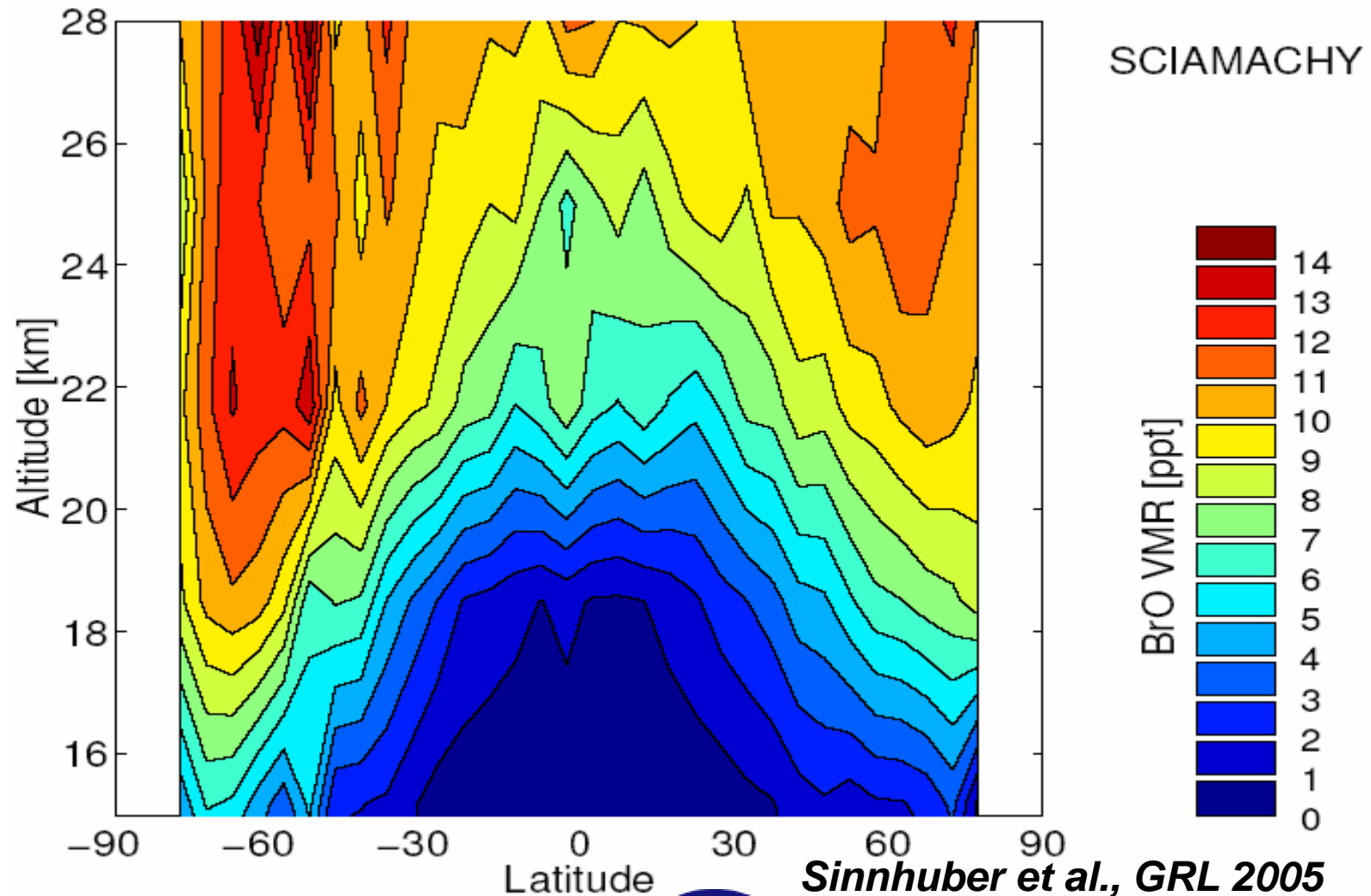
What temperature and trace gas concentration profiles could have produced a set of observed radiances ?

For more information on retrieval

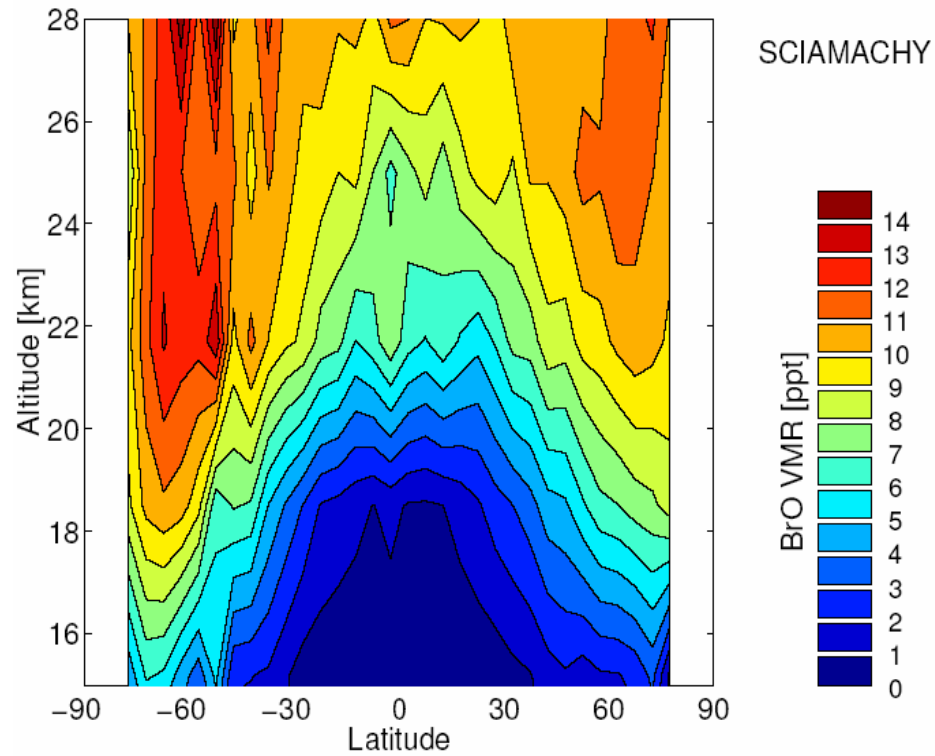
- Rozanov et al., *Advances in Space Research*, 2005.
- www.iup.uni-bremen.de/scia-arc/

- SCIAMACHY BrO is compared with results from a 1 D photochemical model to test our understanding of bromine chemistry.
- Since bromine chemistry is controlled by NO_2 , we constrain the model with SCIAMACHY NO_2 measurements.

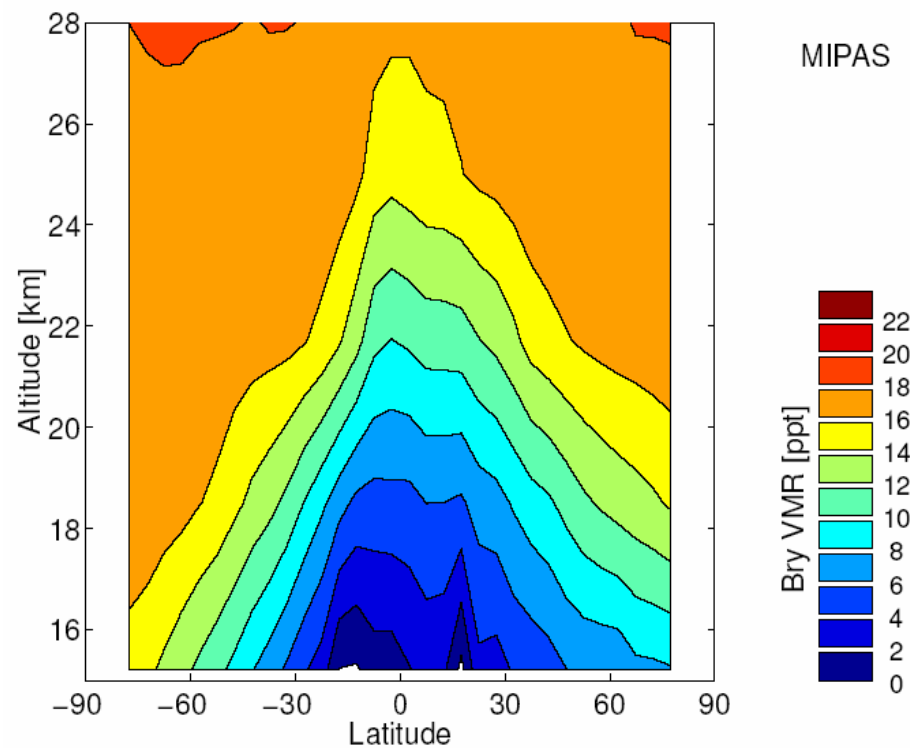
Zonal mean of SCIAMACHY BrO for a 10 day period in Sep. 2002



SCIAMACHY BrO

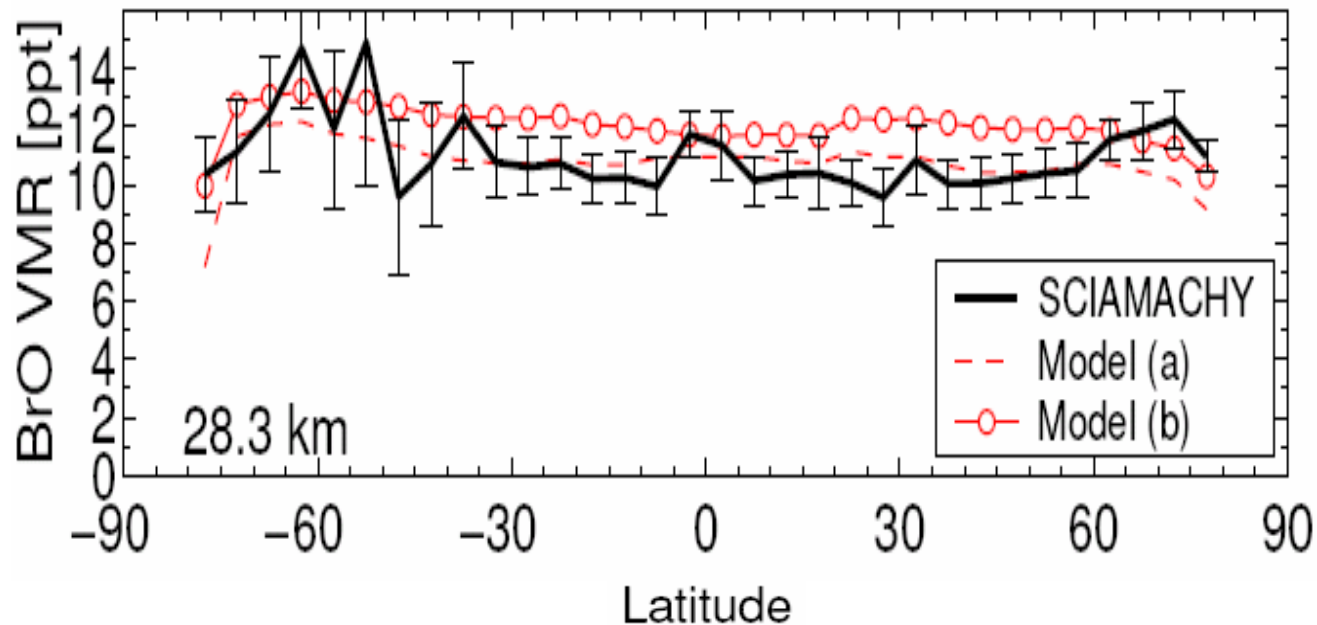


Estimated Br_y from MIPAS CFC-11



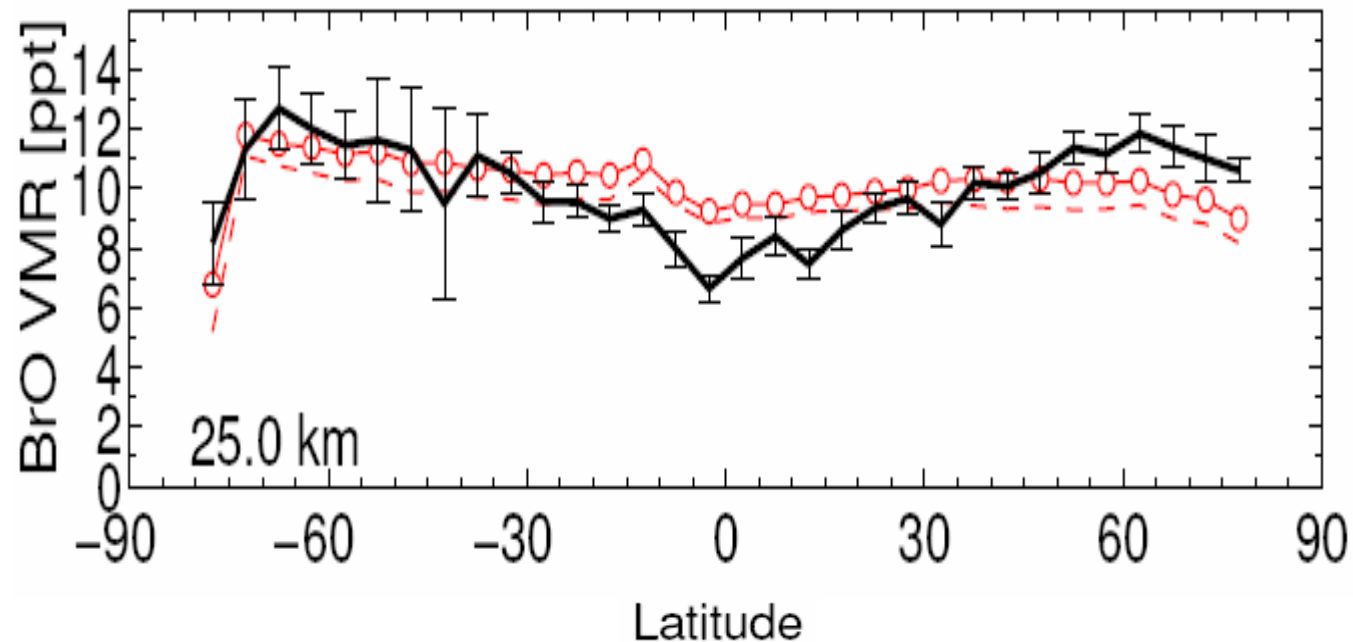
Sinnhuber et al., GRL 2005

Comparison of SCIAMACHY and modeled BrO



Sinnhuber et al., GRL 2005

Comparison of SCIAMACHY and modeled BrO



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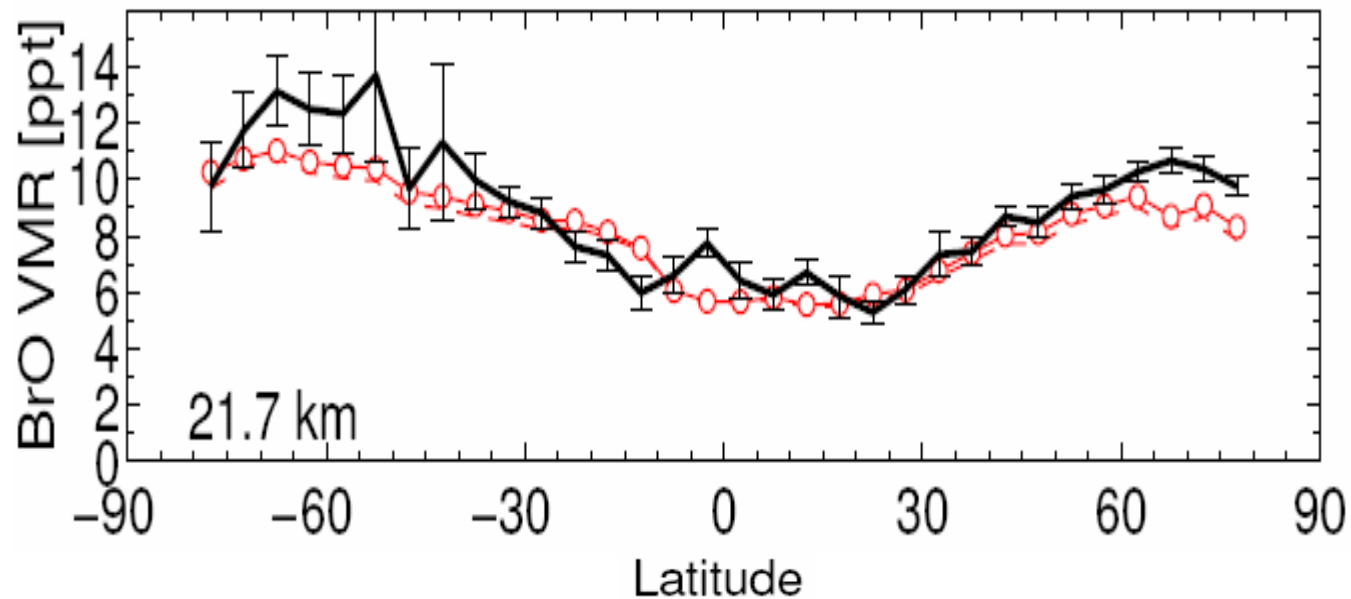
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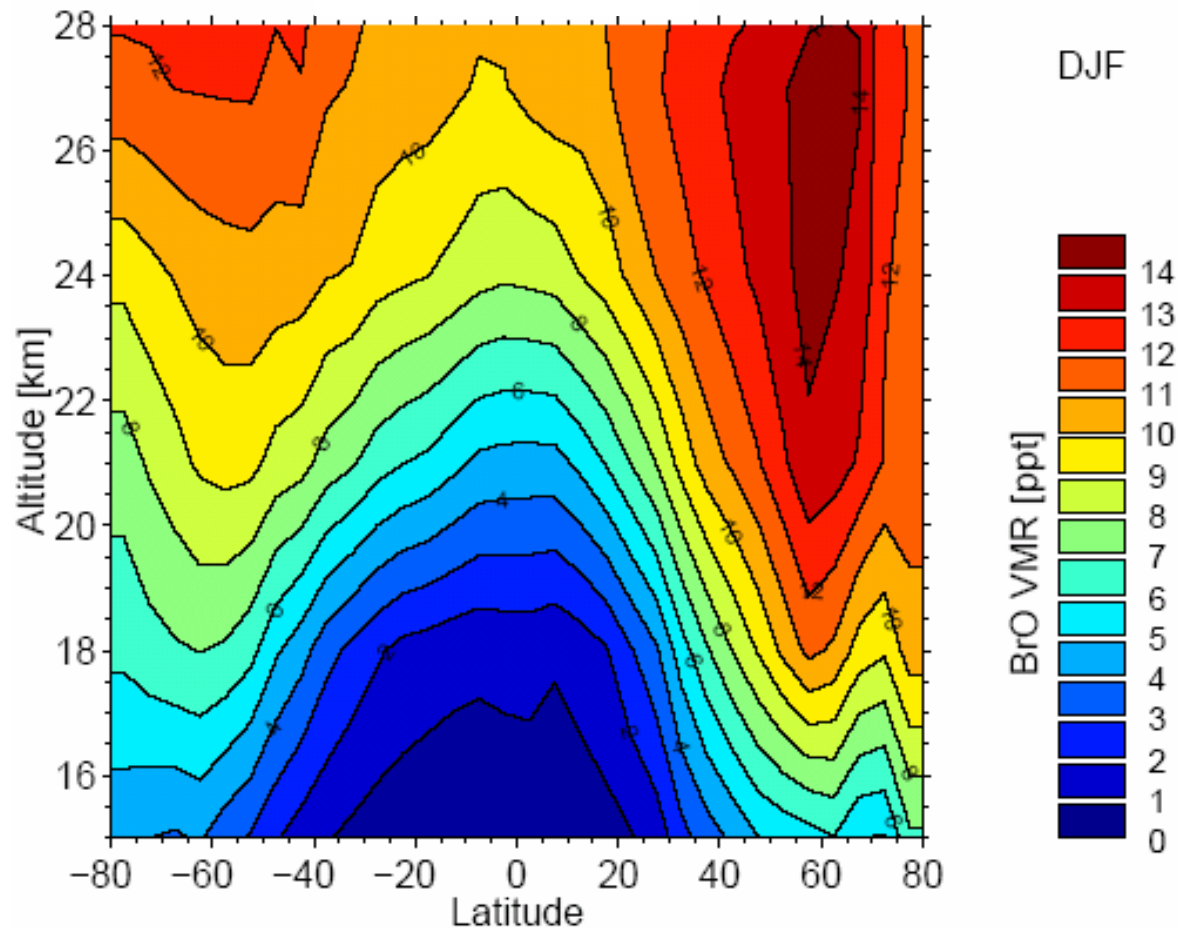
Comparison of SCIAMACHY and modeled BrO



Sinnhuber et al., GRL 2005

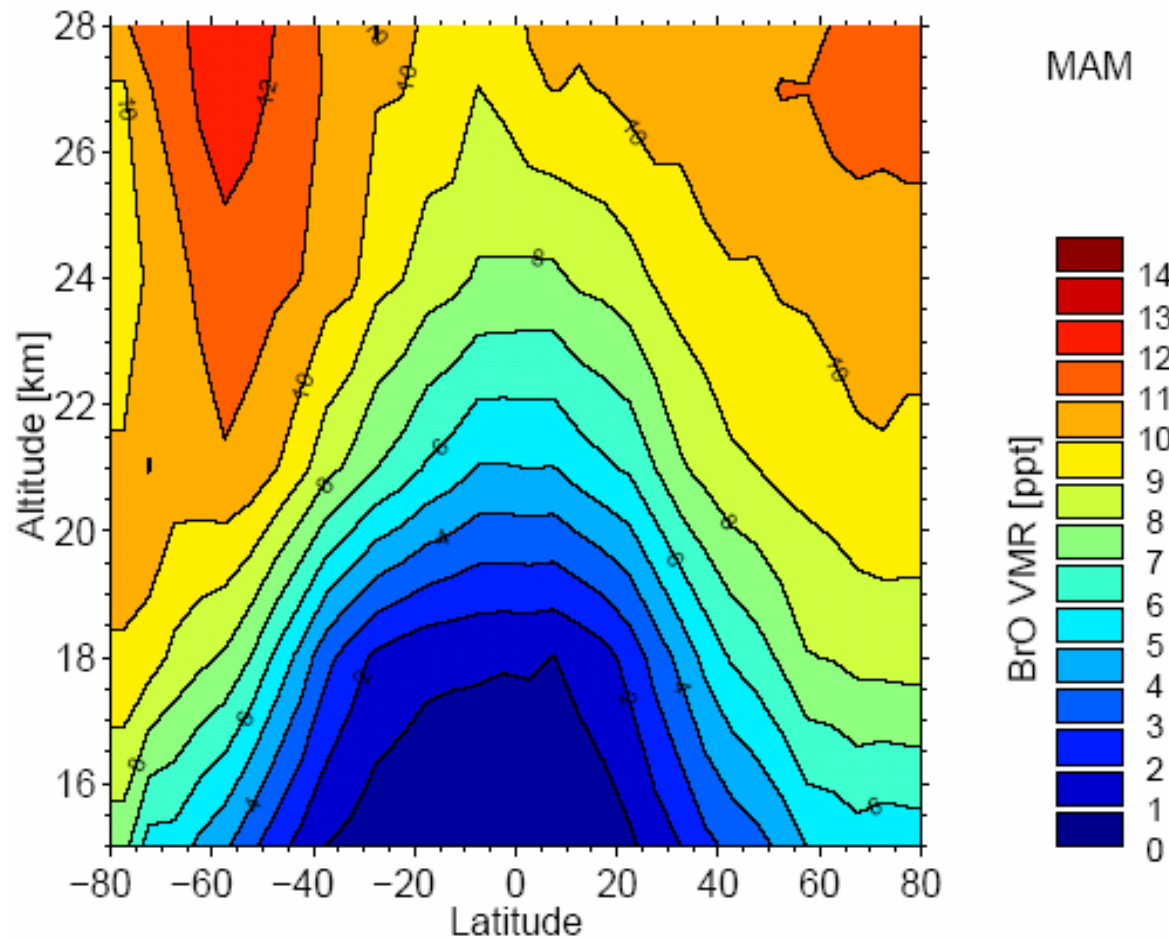
Seasonal mean of BrO in 2003 and 2004

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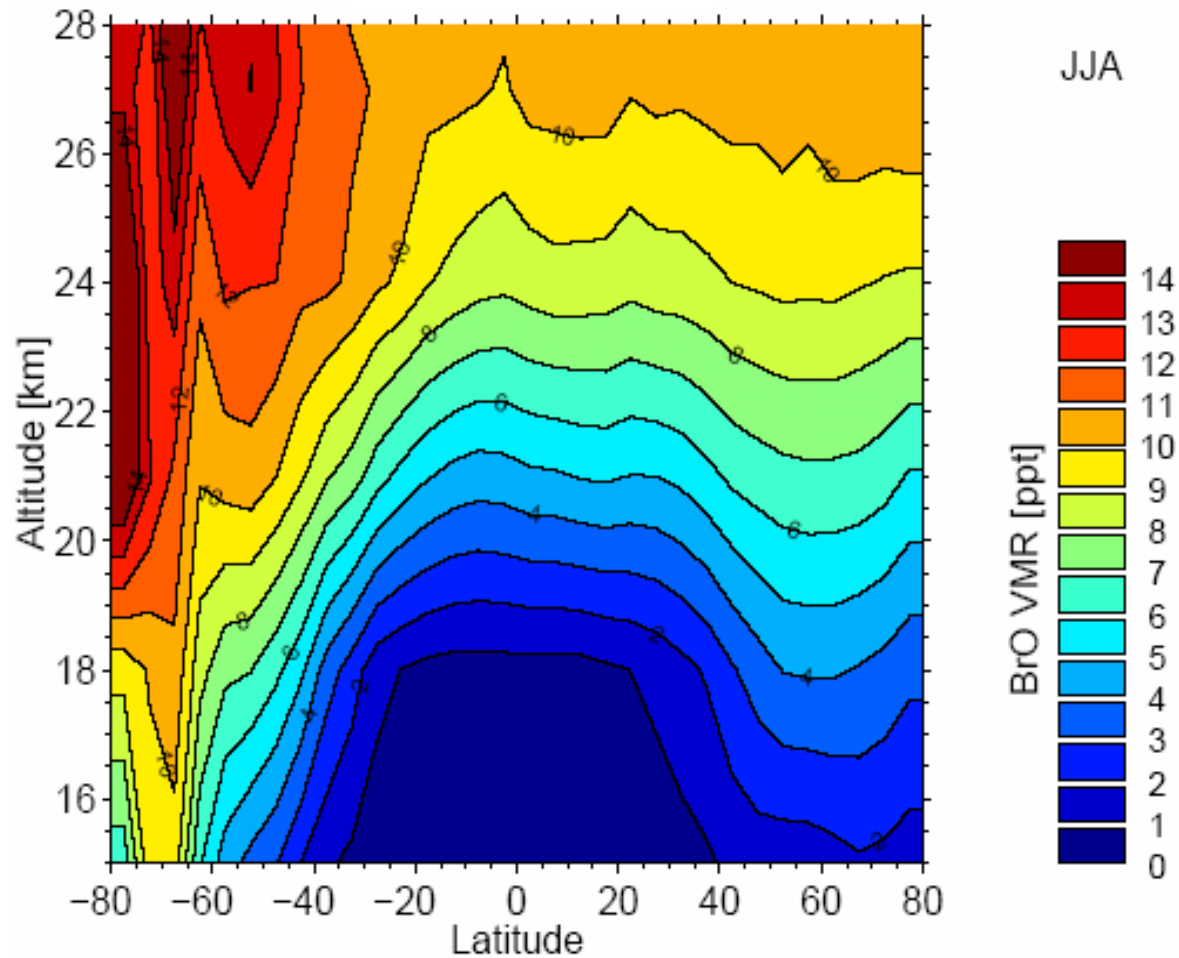
Seasonal mean of BrO in 2003 and 2004

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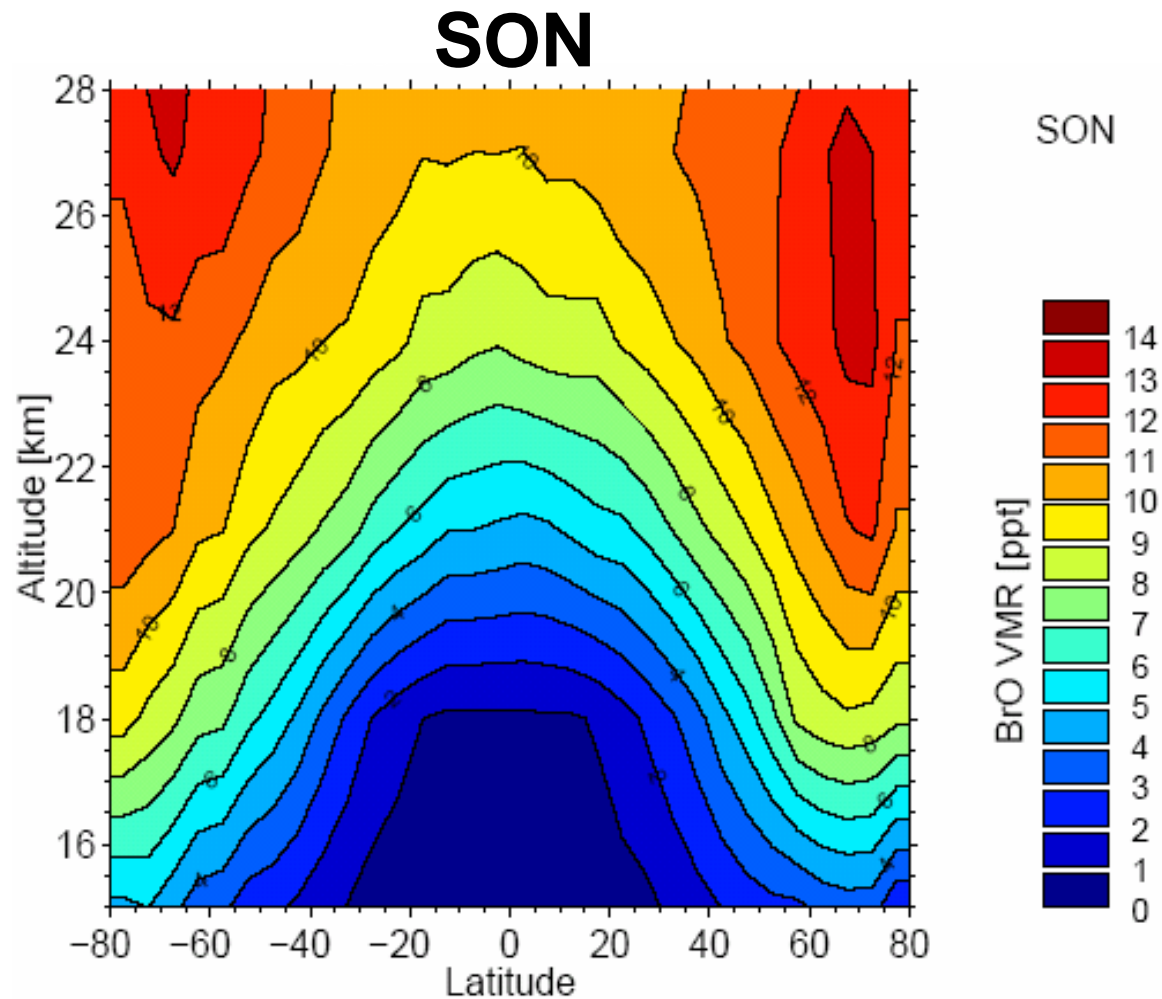


Seasonal mean of BrO in 2003 and 2004

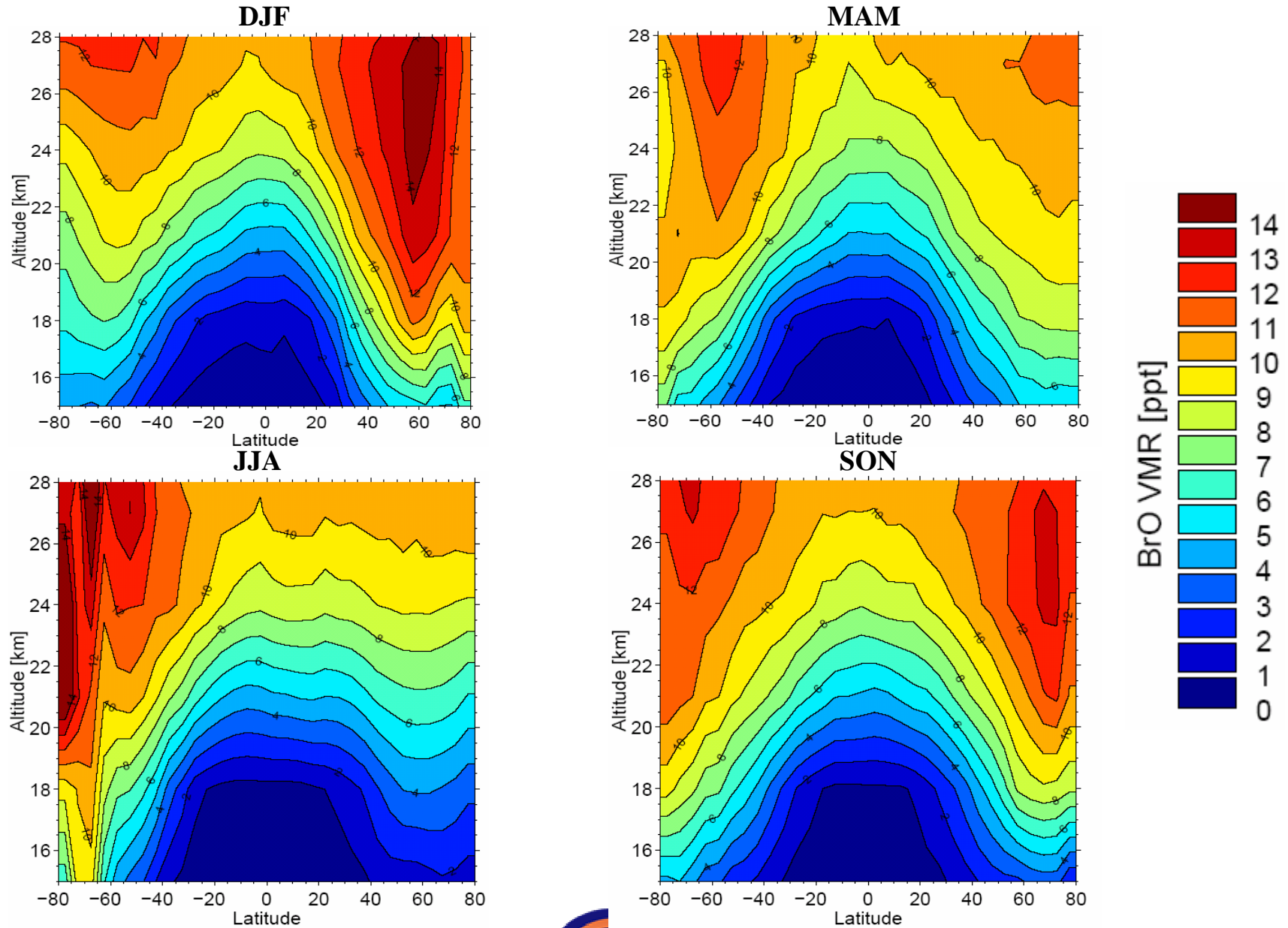
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Seasonal mean of BrO in 2003 and 2004



Seasonal mean of BrO in 2003 and 2004

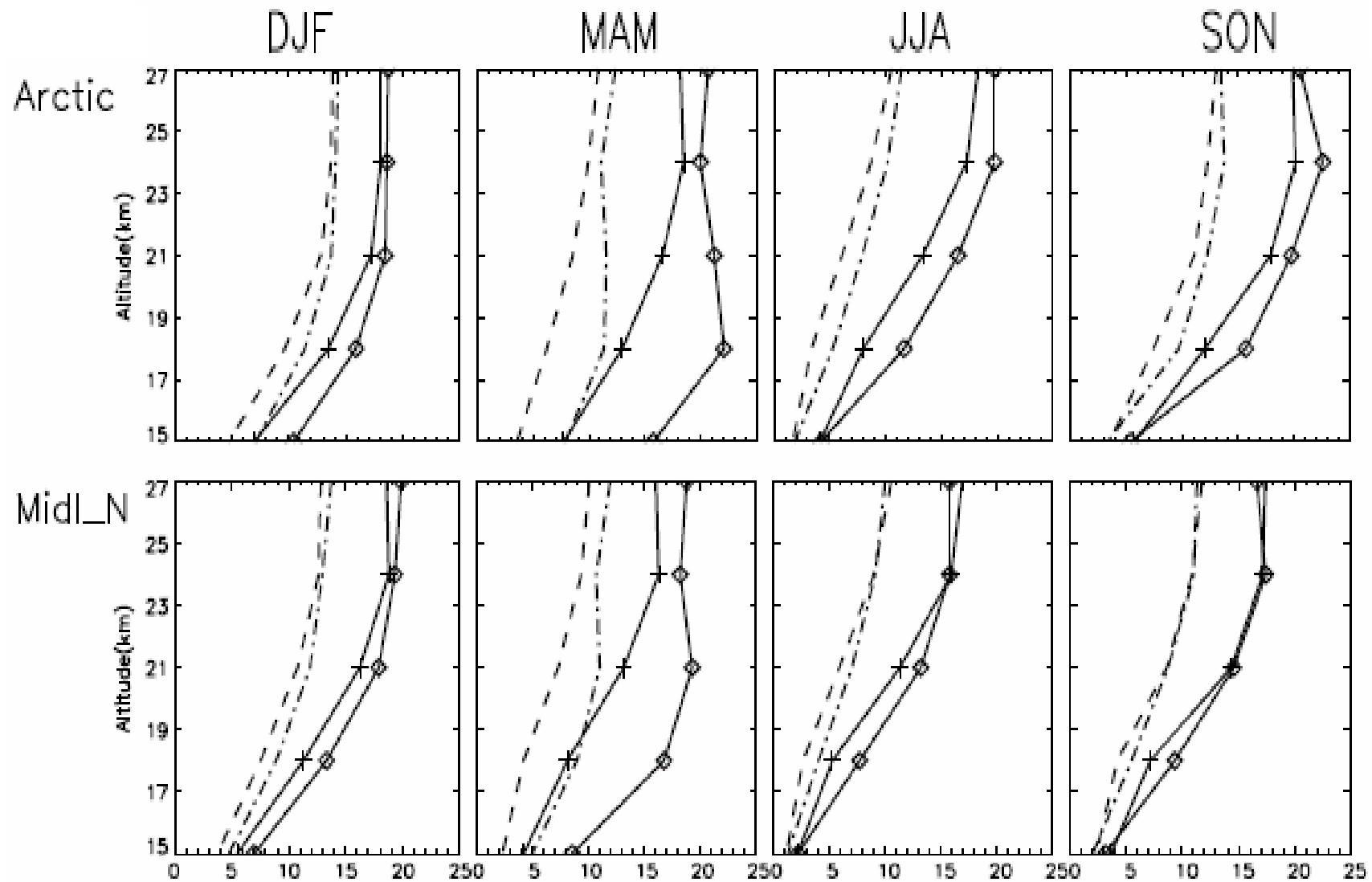


----- Mean BrO in 2003

◇-----◇ SCIAMACHY estimated Br_y in 2003

----- Mean BrO in 2004

+-----+ SCIAMACHY estimated Br_y in 2004

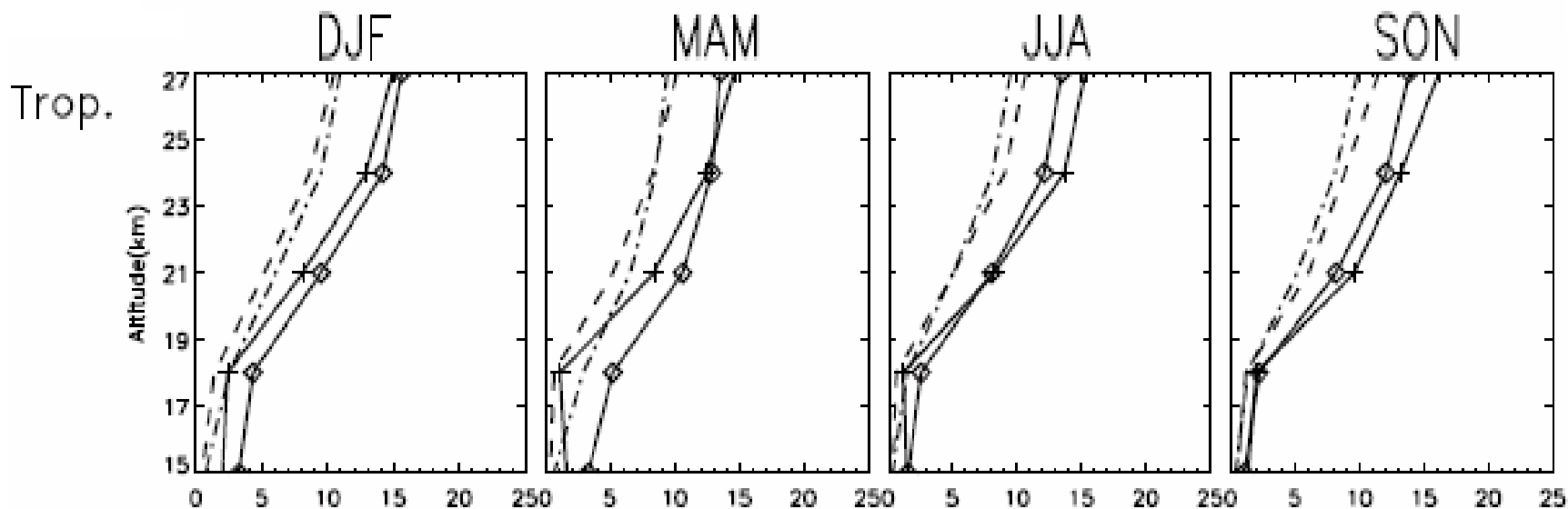


----- Mean BrO in 2003

◇-----◇ SCIAMACHY estimated Br_y in 2003

- - - - - Mean BrO in 2004

+-----+ SCIAMACHY estimated Br_y in 2004



----- Mean BrO in 2003

◇-----◇ SCIAMACHY estimated Br_y in 2003

----- Mean BrO in 2004

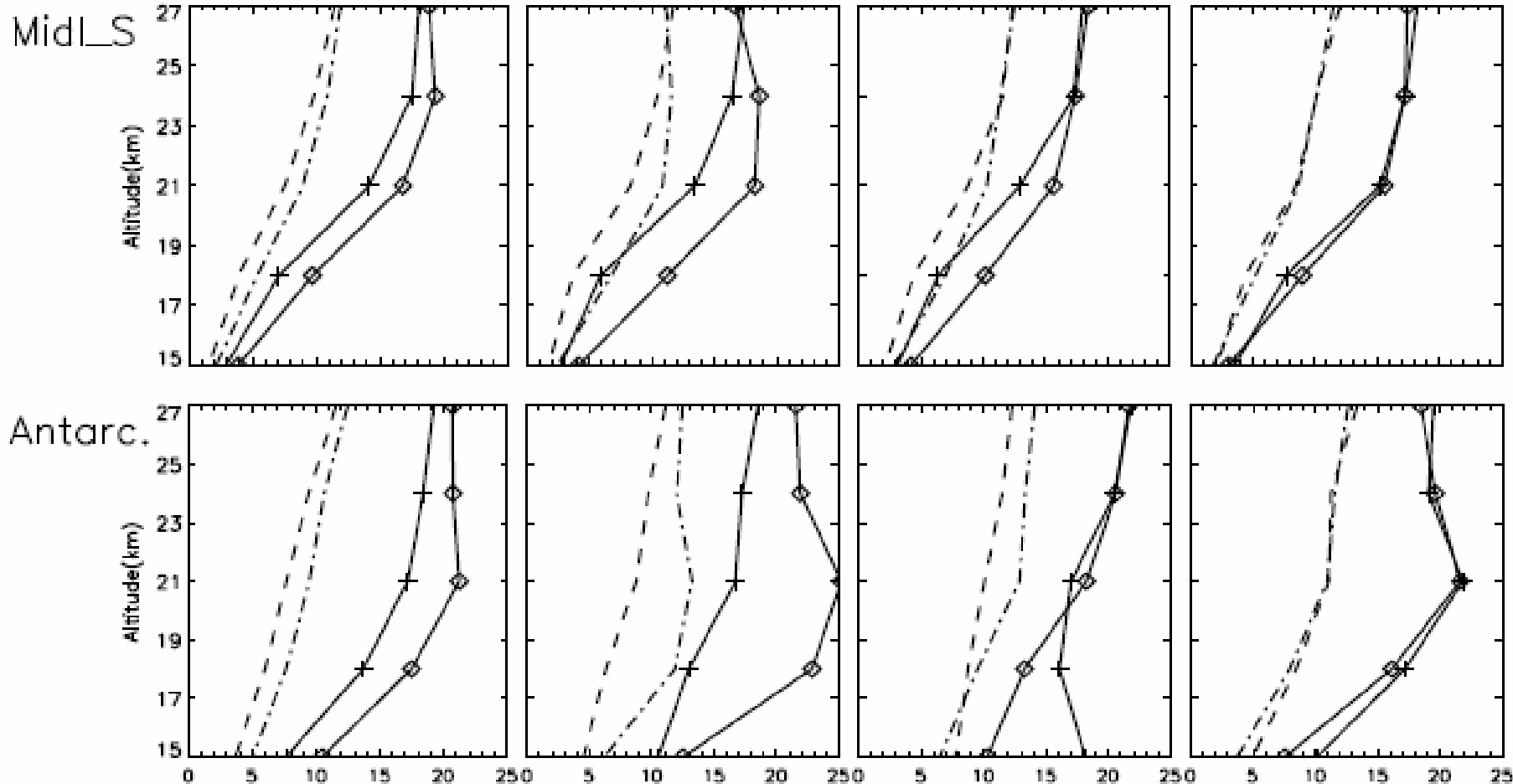
+-----+ SCIAMACHY estimated Br_y in 2004

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Conclusions

- SCIAMACHY provides global profiles of BrO.
- SCIAMACHY BrO agrees well with the 1 D photochemical model.
- Climatology of the two years of data has been presented.
- Total bromine content in the atmosphere is estimated to be 18 ± 4 pptv, consistent with previous works of Pfeilsticker et al. (21.5 ± 3 pptv) [2000], Harder et al., (20 ± 2.5 pptv) [2000], Sinnhuber et al. (20 ± 4 pptv) [2002].
- Implies a contribution of 3 ± 4 pptv from short lived source gases.



Thank you for your attention!